CLAIMS

1. A process for producing linear alkyl benzene, the process including the steps of obtaining a hydrocarbon condensate containing olefins, paraffins and oxygenates from a low temperature Fischer-Tropsch reaction;

   a) fractionating a desired carbon number distribution from the hydrocarbon condensate to form a fractionated hydrocarbon condensate stream;
   b) extracting oxygenates from the fractionated hydrocarbon condensate stream from step (a) to form a stream containing olefins and paraffins;
   c) combining the stream containing olefins and paraffins from step (b) with the feed stream from step (g) to form a combined stream;
   d) alkylating olefins in the combined stream from step (c) with benzene in the presence of a suitable alkylation catalyst in an alkylation reactor;
   e) recovering linear alkyl benzene from the alkylation reactor;
   f) recovering unreacted paraffins from the alkylation reactor;
   g) dehydrogenating the unreacted paraffins in the presence of a suitable dehydrogenation catalyst to form a feed stream containing olefins and paraffins; and
   h) sending the feed stream containing olefins and paraffins from step (g) to step (c).

2. A process according to claim 1 wherein the low temperature Fischer-Tropsch reaction is carried in a slurry bed reactor at a temperature of 160°C - 280°C and in the presence of a cobalt catalyst to provide a hydrocarbon condensate containing 60 to 80% by weight paraffins and 10 to 30% by weight olefins.

3. The process according to claim 2, wherein the Fischer-Tropsch reaction is carried out at a temperature of 210°C - 260°C.

4. The process according to any one of claims 1 - 3, wherein the Fischer-Tropsch reaction is carried out in the presence of a cobalt catalyst.

5. The process according to any one of claims 2 - 4, wherein the hydrocarbon condensate contains less than 25% by weight olefins.

6. The process according to claims 2 - 5, wherein the olefins in the hydrocarbon condensate have a linearity of greater than 92%.

7. The process according to claim 6, wherein the olefins in the hydrocarbon condensate have a linearity of greater than 95%.

8. The process according to any one of claims 1 – 7, wherein the paraffins in the hydrocarbon condensate have a linearity greater than 92%.

9. The process according to any one of claims 1 – 8, wherein the hydrocarbon condensate is fractionated, in step a), into the C_8 to C_{16} range.

10. The process according to claim 9, wherein the hydrocarbon condensate product is fractionated, in step a), into the C_{10} to C_{13} range.

11. The process according to claim 10, wherein the fractionated hydrocarbon product contains 10 to 30% by weight olefins with a degree of linearity greater than 92%.

12. The process according to any one of claims 1 – 11, wherein the oxygenates are extracted, in step (b), by distillation, dehydration or liquid-liquid extraction.

13. The process according to claim 12, wherein the oxygenates are extracted by liquid-liquid extraction.

14. The process according to claim 13, wherein a light solvent is used in the liquid-liquid extraction.

15. The process according to claim 14, wherein the light solvent is a mixture of methanol and water.

16. The process according to claim 15, wherein the oxygenate extraction process is a liquid-liquid extraction process that takes place in an extraction column using a mixture of methanol and water as the solvent, wherein an extract from the liquid-liquid extraction is sent to a solvent recovery column from which a tops product comprising methanol, olefins and paraffins is recycled to the extraction column, thereby enhancing the overall recovery of olefins and paraffins.

17. The process according to claim 16, wherein a bottoms product from the solvent recovery column is recycled to the extraction column.

18. The process according to any one of claims 15 – 17, wherein the solvent has a water content of more than 3% by weight.

19. The process according to claim 18, wherein the solvent has a water content of from 5% - 15% by weight.

20. The process according to any one of claims 16 – 19, wherein a raffinate from the extraction column is sent to a stripper column from which a hydrocarbon feed stream containing more than 90% by

weight olefins and paraffins and less than 0.2% by weight oxygenates exits as a bottoms product.

21. The process according to claim 20, wherein the hydrocarbon feed stream contains less than 0.02% by weight oxygenates.

22. The process according to any one of claims 1 - 21, wherein the recovery of olefins and paraffins in the hydrocarbon feed stream over the extraction step b) is in excess of 70%.

23. The process according to claim 22, wherein the recovery of olefins and paraffins in the hydrocarbon feed stream is in excess of 80%.

24. The process according to any one of claims 1 - 23, wherein the olefin/paraffin ratio of the fractionated hydrocarbon condensate stream a) is substantially preserved over the extraction step b).

25. The process according to any one of claims 1 - 24, wherein the dehydrogenation reaction at step (g) is carried out at a conversion rate of 10%-15%.

26. The process according claim 25, wherein the fractionated hydrocarbon condensate from step (b) has an olefin concentration of from 10% to 30% by weight, the feed stream from step (g) has an olefin concentration of 10% to 15% by weight, and the combined stream at step (c) has an olefin concentration of 12.5% to 22.5% by weight.

27. A fractionated hydrocarbon condensate product from a Fischer-Tropsch reaction, in the C_8 to C_{16} range, containing olefins with a degree of linearity of greater than 92%, for use in a process for manufacturing linear alkyl benzene.

28. The fractionated hydrocarbon condensate product according to claim 27 in the C_{10} to C_{13} range.

29. The fractionated hydrocarbon condensate according to claim 27 or claim 28, wherein the olefins have a degree of linearity of greater than 95%.

30. A linear alkyl benzene product formed from the alkylation of olefins which are the product a Fischer-Tropsch reaction, wherein the linear alkyl benzene product has a degree of linearity of greater than 92%.

31. The linear alkyl benzene product according to claim 30, wherein the linear alkyl benzene product has a degree of linearity of greater than 93%.

32. A process of producing three hydrocarbon fractions from a hydrocarbon condensate and a wax fraction product stream from a Fischer-Tropsch reaction, the hydrocarbon fractions being:

1) hydrocarbon fraction A, being a hydrocarbon fraction having a boiling point above 25°C and an end point below 200°C;
2) hydrocarbon fraction B including at least a mixture of alkanes, alkenes and oxygenates having a boiling point in the range 100-300°C; and
3) hydrocarbon fraction C having a boiling point in the range 120-400°C;

the method including the steps of:

a) fractionating the hydrocarbon condensate stream, or a derivative thereof, from the Fischer-Tropsch reaction to form at least three fractionated hydrocarbon condensate streams wherein at least one of the three fractionated hydrocarbon condensate streams is hydrocarbon fraction B;
b) hydroconverting at least the wax fraction product stream, or a derivative thereof, from the Fischer-Tropsch reaction;

c) fractionating the hydroconverted wax product from step b) to obtain at least a hydroconverted light hydrocarbon stream and a hydroconverted distillate stream; and
d) selectively blending the products of steps a) and c) to obtain hydrocarbon fractions A and C; and
e) transferring the hydrocarbon condensate stream from step (a) that constitutes hydrocarbon fraction B to a process for the production of linear alkyl benzenes.

33. The process according to claim 32, including the additional step of transferring a waxy unconverted fraction from step b) to a process for the production of high viscosity index base oils by either solvent extraction or catalytic isodewaxing.

34. The process according to claim 32, wherein the Fischer-Tropsch reaction is a low temperature Fischer-Tropsch reaction carried out in a slurry bed reactor at a temperature of 160°C - 280°C, and in the presence of a cobalt catalyst to provide a hydrocarbon condensate containing 60 to 80% by weight paraffins and 10 to 30% by weight olefins.

35. The process according to claim 34, wherein the low temperature Fischer-Tropsch reaction is carried out in a slurry bed reactor at a temperature of 210°C - 260°C.

36. The process according to claim 35, wherein the hydrocarbon condensate contains less than 25% by weight olefins.

37. The process according to claim 32, wherein the hydrocarbon fraction A has a boiling point above 30°C and an end point below 175°C.

38. The process according to claim 37, wherein the hydrocarbon fraction A has an end point below 160°C.

39. The process according to claim 32, wherein the hydrocarbon fraction B has a boiling point in the range of 145°C - 255°C.

40. The process according to claim 39, wherein the temperature range is 165°C - 240°C.

41. The process according to claim 32, wherein the hydrocarbon fraction C has a boiling point in the range 150°C - 380°C.

42. The process according to claim 41, wherein the hydrocarbon fraction C has a boiling point in the range of 160°C - 360°C.

43. The process according to claim 32, wherein the process for the production of linear alkyl benzenes referred to in step e) comprises alkylation and catalytic dehydrogenation.

44. The process according to claim 32, wherein an additional hydrocarbon fraction is produced, the additional hydrocarbon fraction being hydrocarbon fraction D including medium to high molecular mass alkanes, both linear and isomerised, having a boiling point above 380°C.

45. The process according to claim 44, wherein the hydrocarbon fraction D includes medium to high molecular mass paraffins having a boiling point above 400°C.